

Harlan & Hollingsworth Company Factory, circa 1880
Southwest side of Lancaster Avenue
Wilmington
New Castle County
Delaware

HAER DE-8

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD

Harlan and Hollingsworth Company Factory

HAER DE-8

Location: Wilmington, Delaware
UTM: 18.452250.4398650
QUAD: Wilmington South

Date of construction: c. 1880, considerably altered

Present Owner: Arthur J. Siler, President
Lamont Gear Works
Philadelphia, Pennsylvania

Significance: The Harlan & Hollingsworth Co. began the manufacture of railway passenger cars in 1836 and commenced iron shipbuilding in 1843. Energetic management, competent production, and expanding markets for its products established the firm as Wilmington's leader in both fields. In 1845, Harlan & Hollingsworth launched the Bangor, the first American-built iron vessel for deep sea use. By 1860, at which time Wilmington assumed pre-eminence in the field of iron shipbuilding, Harlan & Hollingsworth was the city's leading concern in that industry.

During the second half of the 19th century, Harlan & Hollingsworth established a national reputation for high-quality railway passenger cars, iron-hulled steamers, steam engines, and boilers. By 1880, the firm's work force numbered over 1,000 and the plant, situated between the Pennsylvania Railroad and the Christina River, spread over 43 acres on Wilmington's south side. In 1904, high cost of materials, labor unrest, and problem-ridden contracts brought the sale of the firm to the Bethlehem Shipbuilding Corporation. Production of ships ceased in 1926 and car manufacture ended in 1939.

Historian: James Edmonson, 1976.

It is understood that access to the material rests on the condition that should any of it be used in any form or by any means, the author of such material and the Historic American Engineering Record of the National Park Service at all times be given proper credit.

The importance of the Harlan and Hollingsworth Company lies in the central role that it played in the development of Delaware's railway car construction and shipbuilding industries. Only a partial and fragmented picture of Wilmington's industrial heritage would result from the exclusion of such a significant company. Unfortunately, examination of the extant structures once occupied by the Harlan and Hollingsworth Company yields few insights into the firm's development and the processes of production. Therefore, documentation has concentrated on the available written and graphic sources.

Harlan and Hollingsworth occupied an important position in Wilmington's 19th century industrial development. The partnership of Mahlon Betts and Samuel Pusey created the city's first railway car manufacturer in 1836. This same firm, known as Harlan and Hollingsworth by 1849, also deserves credit as the first iron shipbuilding concern in Wilmington. [1] The company's success was largely determined by its being established during the era that marked the early development and growth of America's transportation systems. Its Wilmington location proved advantageous with respect to resources, markets, and skilled labor. Diversification of products, an early practice of the firm, resulted in financial stability. Technical sophistication, characterized by use of the most advanced contemporary technologies, the extensive use of laborsaving machinery, and the consolidation of production facilities, also contributed to Harlan and Hollingsworth's success.

II

In part, Harlan and Hollingsworth's prosperous development was a function of the early date at which the firm was established. Rail communication between Philadelphia and Baltimore opened in August 1837, and the Philadelphia, Wilmington, and Baltimore Railroad was created by the merger of existing lines in early 1838. [2] Anticipating the demand for rolling stock for these lines, Harlan and Hollingsworth began railway car construction in 1836. [3]

The manufacture of cars was, at that time, essentially a wood-working industry requiring limited capital investment. In 1836, \$5,000 proved sufficient for the firm to establish a car building shop at Front and Tatnall Streets, near the proposed route of the Philadelphia, Wilmington, and Baltimore Railroad. [4] Even before the line opened in 1837, Harlan and Hollingsworth completed one passenger car for the Wilmington and Susquehanna Railroad costing \$2,100. [5]

After a brief period of considerable experimentation during the early years of railway travel, passenger car design and construction became standardized during the late 1830s. Harlan and Hollingsworth followed the trends set by larger rail lines, particularly the Baltimore and Ohio Railroad. That line adopted the eight-wheeled, box-shaped "American type" car as early as 1835, and the Philadelphia, Wilmington and Baltimore (Harlan and Hollingsworth's major client) followed suit in 1837. [6]

Early entrance into the new field of railroad car construction enabled Harlan and Hollingsworth to start with limited capital, meet the growing demand for cars, and devise its own car design and construction techniques while following the lead of the larger railroad lines. By 1839 over 175 passenger, mail, baggage, and freight cars of both four and eight-wheel design rolled out of the Wilmington shops of Harlan and Hollingsworth. [7] This firmly established the company as a leading producer of railway cars.

In contrast to its calculated entry into car building, marine construction by Harlan and Hollingsworth came about almost by accident in 1843. Since its establishment in 1836, the company had expanded its business to include, "... a fair amount of machine work, principally small jobbing repairs, and occasionally such large contracts as for stationary engines, mill machinery, etc., in addition to their regular business of car building." [8]

In 1841, with little experience in marine work, Harlan and Hollingsworth accepted a contract for repairs on the steam packet Sun. Perhaps the owner of the Sun selected the firm because their new West Street production facilities, located near the Christina River, were capable of performing heavy machine work. Subcontracting casting to the foundry of Betts and Stotsenburg, Harlan and Hollingsworth successfully accomplished the necessary repairs on the vessel. [9] With confidence gained from this experience, the company embarked on the new business of iron shipbuilding.

Unlike the established industry of wood shipbuilding, which was dominated by tradition, the construction of iron ships was an enterprising venture open to iron founders, boiler makers, and machinists. [10] Harlan and Hollingsworth was the first Wilmington concern engaged in this line of work.

To fulfill its first contracts, Harlan and Hollingsworth relied upon the experience and assistance of local shipbuilders, W. and A. Thatcher. In 1844 the company began the construction of the Bangor

for a packet line running between Bangor, Maine and Boston. The 29 May 1845 launching of the Bangor, the first American-built iron merchant vessel for deep sea use, marked a turning point in Harlan and Hollingsworth's history. [11] Subsequently the company engaged in two distinct specialties -- car building and iron ship construction.

During this early period Harlan and Hollingsworth occupied a dominant position in America's iron shipbuilding industry. The firm combined the technical competence, "... to execute contracts regularly for the large class of iron vessels," with the willingness to enter a new industry with an uncertain future. [12] By 1860 Wilmington became the center of American iron shipbuilding, with Harlan and Hollingsworth established as the city's largest manufacturer of iron vessels. [13]

III

The city of Wilmington offered a number of advantages that originally induced Harlan and Hollingsworth to establish car and shipbuilding facilities in that city, and subsequently contributed to the firm's success.

The Wilmington location proved advantageous because of easy accessibility materials. Bulk shipment of iron and coal at low rates from nearby Pennsylvania was convenient for the growing iron-based industries of Wilmington. From 1843, Harlan and Hollingsworth consumed increasing amounts of iron in the construction of iron-hulled ships, steam engines, boilers, and railway car fittings. Between 1850 and 1880, the annual value of materials rose from \$90,000 to over \$1,150,000. [14] In 1860 the company required iron castings, iron puddle plate, iron boiler plate, wrought iron, lumber, coal, and miscellaneous items, worth \$312,500. [15] Evidently, Wilmington's proximity to the source of these materials was a key factor in the firm's success. Prohibitive transportation costs of raw materials would have reduced Harlan and Hollingsworth's competitive position.

Wilmington's thriving community of machinists, iron founders, and shipbuilders played no small part in Harlan and Hollingsworth's development. Prominent early figures in the firm were trained by Wilmington's foremost machinist, Jacob Alrichs. [16] Shops like Alrichs' supplied iron castings, plate, and fittings used in car, ship, engine, and boiler construction. Shipyards of Wilmington

rented necessary shipbuilding facilities on the Christina, provided expertise concerning design and construction techniques, and until 1857, performed joiner work on ships built by Harlan and Hollingsworth. [17] Without the existence of such an industrial community, it is doubtful that Harlan and Hollingsworth would have entered shipbuilding.

Cheap land was available near the banks of the Christina on Wilmington's south side. Establishment of secondary iron-based industries along the Christina River hinged on one key factor -- the availability of power other than water-power. The gentle currents of the Christina did not develop power comparable to that generated by the Brandywine. An alternate motive force -- steam power -- was, therefore, a pre-requisite for Wilmington's growth as an industrial center. Appropriately enough, the first local application of steam-power to industrial production was in the foundry of Mahlon Betts, co-founder of Harlan and Hollingsworth, in 1829. [18] With the introduction of stationary steam engines, the location of industry in Wilmington was no longer dictated by available natural sources of power. The low cost of land allowed the company to establish a plant without major expense and encompass adjacent properties in later expansion of production facilities.

Situated between the Philadelphia, Wilmington, and Baltimore Railroad and the Christina River, the company benefitted from access to the main transportation facilities serving Wilmington. Raw materials arrived and finished products departed by rail and water. Wilmington's rail system proved a ready customer for cars, and provided communication with other rail lines as well. The Christina River, although limited in breadth and depth, connected the city with the Delaware River, which opened into the Delaware Bay. [19]

Another factor contributed to Harlan and Hollingsworth's success -- low cost labor. As noted in the 1880 United States Census report on the American shipbuilding industry, "Wilmington had skilled labor ..., and a low scale of wages prevailed, because operatives could afford to accept them on account of cheap rents and moderate living expenses." [20] Cheap labor gave Wilmington a competitive advantage over other industrial areas, particularly nearby Delaware River shipbuilding centers. [21]

IV

From the company's earliest years, manufactures were considerably varied. Diversity, in the fields of shipbuilding, railroad car,

steam engine and boiler construction, fostered the financial stability which carried the concern through times of economic hardship. Harlan and Hollingsworth also branched out into a variety of repair work. The firm reconditioned rolling stock for local rail lines and refitted vessels with new machinery. [22] Repair and maintenance did not become the mainstay of Harlan and Hollingsworth's work, but served as an alternate source of income when orders for ships and cars slackened periodically.

In its railroad work, Harlan and Hollingsworth chose, from the beginning, to emphasize passenger car construction. Later in the 19th century, the car shops of Harlan and Hollingsworth were, "... devoted exclusively to the construction of passenger cars, comprising the various classes, from the ordinary smoking-car to the largest and most elegant sleeping and drawing room coaches." [23] The company served both domestic and foreign markets by manufacturing standard gauge cars for the American railroads and narrow gauge cars for export to Europe and South America.

Iron vessels of all types, ranging from the 20 ton steam yacht Meteor to the 4,400 ton side-wheel steamer C. W. Morse, were built by Harlan and Hollingsworth. [24] The size of ships was limited by the depth and width of the Christiana, so the firm specialized in medium-size ocean passenger and freight steamers; river, bay and sound steamers for passenger lines; and private yachts and launches. [25]

Finally, Harlan and Hollingsworth rounded out their production by the construction of steam engines and boilers. Annual production in 1870 included 8 marine engines, both for their own vessels and for general sale; 12 stationary engines; and 30 boilers. [26] Stationary engines were made in "portable" varieties for agricultural use, combining both engine and boiler in one unit, mounted on a carriage. [27] Harlan and Hollingsworth specialized in the construction of "Scotch" type boilers for marine use. [28]

V

Another significant factor contributing to Harlan and Hollingsworth's prosperity was the maintenance of a high degree of technical sophistication. This abiding interest manifested itself in several forms. To improve production the company initiated inquiries into "the state of the art" of car manufacture and shipbuilding. By the introduction of a variety of heavy machinery to reduce manual labor to a minimum and the integration of production, Harlan and Hollingsworth

could produce virtually all the component parts necessary for car, ship, engine and boiler construction.

Harlan and Hollingsworth consistently demonstrated an interest in advanced industrial practices. Travel was an important means of keeping up with technology. Before forming their partnership in 1836, Mahlon Betts and Samuel Pusey, accompanied by Samuel Harlan, visited stage and railway coach-making establishments throughout New England, including the car shops of Lowell, Massachusetts. [29] The journey provided invaluable insights into car design and construction. Another notable example of this practice was the 1881-1883 trip of J. T. Gause, N. R. Benson, Jr., and Edwin Jackson to the shipbuilding yards of Great Britain. Their trip resulted in a published work that noted British mechanical equipment, construction techniques, material handling, fire prevention, and managerial practices. [30]

As plant facilities were enlarged and improved a wide variety of steam-powered equipment was introduced to perform tasks requiring considerable manual labor. In 1880, Harlan and Hollingsworth's plant was described as follows:

The concern covers 43 acres of ground, on which there are about fifty different shops and buildings. Those employed in ship work are supplied with machinery modern in type and massive in build. The plant includes, among other things, shears for trimming heavy plates, planers, rolls for bending plates to the proper curvature on the sides of the ship, machines for punching rivet holes in frames and plates, hydraulic riveting apparatus, by means of which rivets can be clinched solidly with one thrust by steam-power, frame-heating furnaces, bed-plates for bending the angle-iron frames to the proper outline, steam-hammers, mold-lofts and pattern shops, and the proper apparatus for constructing engines and boilers. On the wharf there is a set of masting shears that can handle a weight of 100 tons, and engines and boilers are lifted almost bodily into the air and deposited gently in their places in the hulls floating alongside. The secret of the success of ironship building in America is, in large part, the use of laborsaving machinery of this description. [31]

To encourage the introduction of laborsaving techniques, the company offered employees a considerable reward for suggestions and inven-

tions relating to production innovations. [32]

Throughout the period of Harlan and Hollingsworth's operation a conscious effort was made to integrate production, so far as was feasible. The first major move was the consolidation of shipbuilding facilities. The components of a ship, previously manufactured in shops near the Philadelphia, Wilmington, and Baltimore Railroad, were hauled to a rented yard for assembly. Construction in company owned yards closer to existing machine, foundry, and car building shops became a reality after the acquisition of adjoining waterfront acreage in 1852. [33] Although ship and car construction continued to be concentrated in separate areas of the company's property, the two shared the services of woodworking, upholstery, and machine shops. By the integration of these and other aspects of production, Harlan and Hollingsworth eliminated a duplication of efforts in shipyard and car shops. In respective areas of manufacture the company avoided reliance upon subcontractors. One visitor to the car in 1873 observed that, "Nearly every detail which goes to make up the completed car is produced in the shops." [34] The same held true for shipbuilding.

Harlan and Hollingsworth's success was the outcome of a combination of factors. Technical excellence, in both design and construction, was an important deciding factor. Innovative, high-quality products earned an industry-wide respect and reputation for Harlan and Hollingsworth.

VI

During the final years of the 19th century Harlan and Hollingsworth was plagued by strikes, high steel prices, problem-ridden Navy contracts, and by limitations on the type and size of ships it could produce. [35] In the wake of these set-backs the company was sold to the United States Shipbuilding Company in August 1902, which in turn became the property of the Bethlehem Shipbuilding Company on 10 December 1904. [36]

Bethlehem improved the shipyard and car-building facilities in 1905 and 1906. [37] Railway car construction, in particular, restored the firm's stability following the economic panic of 1907. Beginning in 1917, the United States Shipping Board - Emergency Fleet Corporation supervised wartime production. [38] Bethlehem's Harlan Plant built over 70 vessels between 1917 and 1926, but was hit hard by the post-war decline which forced the closure of the yards in 1926. [39] Passenger car construction ceased in 1939. [40]

The most notable factors influencing Harlan and Hollingsworth's demise were the development of alternate forms of transportation, particularly the advent of the automobile, and the disinterest of the parent company, Bethlehem Steel. The passing of Harlan and Hollingsworth marked the end of an era in Wilmington's industrial development.

NOTES

[1] To avoid confusion from the numerous names of the firm under consideration, the company will be referred to as the Harlan and Hollingsworth Company.

[2] Jack C. Potter, "The Philadelphia, Wilmington and Baltimore Railroad, 1831-1840: A Study in Early Railroad Transportation," unpublished Master's thesis, University of Delaware, 1960, pp. 90 and 125.

[3] Semi-Centennial Memoir of the Harlan and Hollingsworth Company, A (Wilmington, Delaware, 1886), p. 172.

[4] Semi-Centennial Memoir..., p. 172.

[5] Potter, p. 121.

[6] E. G. Young, "The Development of the American Railway Passenger Car," Bulletin No. 32 The Railway and Locomotive Historical Society (October, 1933), pp. 45 and 54. For additional information on the subject of passenger car development, see August Mencken, The Railroad Passenger Car (Baltimore, Maryland, 1957); Horace Porter, "Railway Passenger Travel, 1825-1880" [reprinted from Scribner's Magazine, September, 1888.] (Scotia, New York, 1962); and V. R. Willoughby, "A Century of Car Design and Examples of Present Construction," Bulletin No. 46 The Railway and Locomotive Historical Society (April, 1938), pp. 7-13.

[7] Semi-Centennial Memoir..., opposite p. 208.

[8] Semi-Centennial Memoir..., p. 180.

[9] Semi-Centennial Memoir..., pp. 188 and 212.

[10] David B. Tyler, The American Clyde: A History of Iron and Steel Shipbuilding on the Delaware from 1840 to World War I (Newark, Delaware, 1958), pp. 3-4. For additional information on iron ship construction, see "The American Clyde," Harper's New Monthly Magazine, Vol. 56, No. 335 (April, 1878), pp. 641-653; Cassiers Magazine, Vol. XIII, No. 4 (February, 1898), pp. 385-408; and Weldon Fawcett, "The Ship Building Yards of the United States," Engineering Magazine, Vol. XIX, No. 4 (July, 1900), pp. 493-510.

- [11] Tyler, p. 8; and Delaware State Journal, 3 June 1845, p. 3.
- [12] Henry Hall, Report of the Ship-Building Industry of the United States, U. S. Census Office, 10th Census, 1880, Vol. 8, Pt. 4 (Washington, 1884), p. 208.
- [13] Tyler, p. 16.
- [14] U. S. Census, State of Delaware, "Industry Schedules [raw data]: 1850-1880," microfilm 71-134, reel no. 2, Eleutherian Mills Historical Library, Wilmington, Delaware [originals in State Archives, Dover, Delaware], schedule 5 (1850), p. 27 and schedule 3 (1880), p. 6. Hereafter cited as Delaware, "Industry Schedules."
- [15] Delaware, "Industry Schedules," schedule 5 (1860), p. 27.
- [16] Semi-Centennial Memoir..., p. 141; and J. Bruce Sinclair, "Delaware Industries. A Survey: 1820-1860," unpublished research report. Hagley Museum, Wilmington, Delaware, 1958, p. 36.
- [17] Semi-Centennial Memoir..., pp. 212-213; and Tyler, pp. 12-13.
- [18] Semi-Centennial Memoir..., p. 129.
- [19] Brian H. Guss and Frank Snyder, The District: A History of the Philadelphia District of the United States Army Corps of Engineers: 1866-1971 (Philadelphia, 1974), p. 65; and Thomas J. Scharf, History of Delaware: 1609-1888, 2 Volumes (Philadelphia, 1888), Vol. II, p. 755.
- [20] Hall, Report, p. 208.
- [21] Carol E. Hoffecker, Wilmington Delaware, Portrait of an Industrial City: 1830-1910 (Charlottesville, Virginia, 1974), pp. 21, 167-168; and Carol E. Hoffecker, "Nineteenth Century Wilmington: Satellite or Independent City?," Delaware History, Vol. 15 (1972-1973), p. 14.
- [22] Potter, p. 121; Sinclair, p. 51; and Semi-Centennial Memoir..., pp. 142 and 180.
- [23] "The Car Manufactories at Wilmington, Delaware," The National Car-Builder, Vol. IV, No. 2 (February, 1873), p. 33.

[24] The C. W. Morse was an, "American paddle-wheel steamer built in 1904 of steel by Harlan and Hollingsworth at Wilmington, Delaware, for the People's Evening Line, service between New York and Albany...She was renamed the Fort Orange on July 7, 1922, and remained in service under that name on the Hudson until dismantled at New Haven." [Carl D. Lane, American Paddle Steamboats (New York, 1943), p. 198.] "In 1876 the Meteor, Hull No. 158, was delivered to the Carson Lumber Company of Lake Tahoe, Nevada. The Meteor was only 75 feet long, 10 feet wide and 5 feet 1 inch depth of hold... On fifteen minutes' notice, she could jump from 12 miles to 21 miles per hour or tow a boom of logs." [William H. Collins, "History of Bethlehem's Wilmington Plant. Formerly the Harlan and Hollingsworth Corporation," Historical Transactions: 1893 - 1943, Society of Naval Architects and Marine Engineers (New York, 1946), pp. 209-210.]

[25] Collins, p. 212.

[26] Delaware, "Industry Schedules," schedule 4 (1870), p. 3.

[27] American Agriculturist, Vol. 17, No. 9 (September, 1858), p. 237.

[28] Roy W. Kelly, and Frederick J. Allen, The Shipbuilding Industry (Boston, 1918), p. 287; "For years the standard steam generator associated with reciprocating engines was the Scotch boiler, so called because of its popularity with shipbuilders on the Clyde. It was of cylindrical-shell, internally-fired type, fitted with corrugated furnaces, wet-back combustion chamber, and return fire tubes." [W. A. Baker and Tre Tryckare, The Engine Powered Vessel (New York, 1965), p. 99.]

[29] Semi-Centennial Memoir..., pp. 206-207; "In 1838, a Federal Government report published figures indicating that the Lowell Shop's output of railroad equipment was exceeded only by Matthias Baldwin and William Norris of Philadelphia, the center of railroad building activity." [David F. Edwards, "Saco-Lowell: 1813-1850. A Saga of New England Enterprise", Newcomen Society of North America pamphlet (New York, 1950), p. 16.]

[30] See J. T. Gause, Memoranda Concerning Foreign Ship-Building: 1881-1883 (Wilmington, 1883), particularly the observations of N. R. Benson, who concluded that "...so far as my humble judgement goes, I am of opinion, that, while the machinery employed by the builders of Great Britain is much ahead of ours, more especially in size, yet the quality of the work turned out is certainly not superior, if it be equal, to the product of an American ship yard." (p. 173).

- [31] Hall, Report, p. 208.
- [32] Morning News (Wilmington), 29 November 1883, p. 4.
- [33] Semi-Centennial Memoir..., pp. 237-240.
- [34] "The Car Manufactories at Wilmington, Delaware," The National Car-BUILDER, Vol. IV, No. 2 (February, 1873), p. 33.
- [35] Hoffecker, Industrial Wilmington, p. 158; and Tyler, pp. 88, 90-91.
- [36] Collins, p. 211.
- [37] Tyler, pp. 98-99.
- [38] Collins, p. 211.
- [39] Bethlehem Shipbuilding Corporation, Ltd., "List of ship-owners and details of their ships built by the Harlan Plant of Bethlehem Shipbuilding Corp., 1844-1921," Acc. 277, Eleutherian Mills Historical Library, Wilmington, Delaware.
- [40] Collins, p. 211.

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